

The background of the slide is a deep blue night sky. In the upper right corner, a bright, detailed crescent moon is visible. Numerous small, white stars are scattered across the sky. On the left side, there are some wispy, dark clouds. The overall atmosphere is serene and nocturnal.

# REM Sleep Monitor

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# Introduction

- Objective
  - Design and build a single channel EEG monitoring device for REM sleep detection
- Purpose
  - To be used for personal or large-scale sleep research

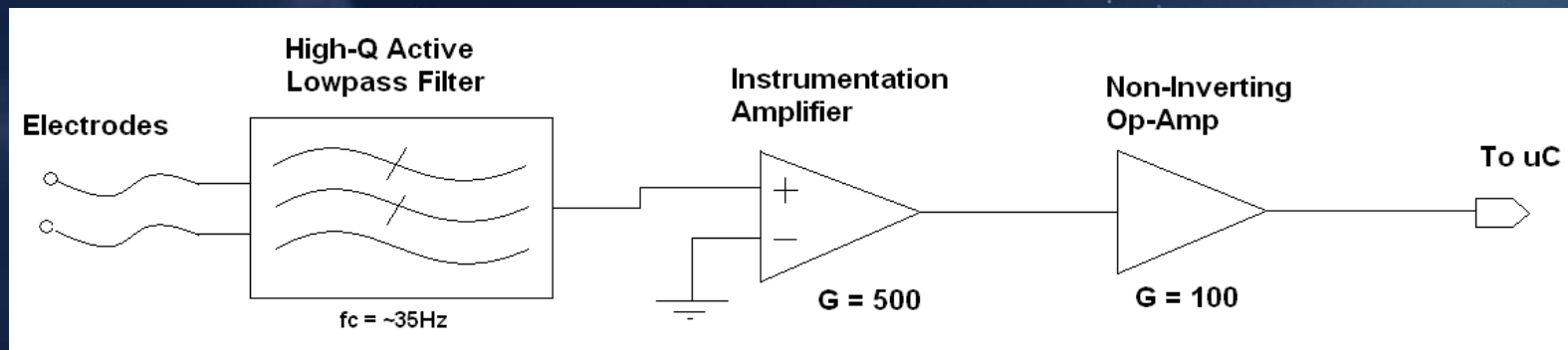
# Requirements

The finished device shall...

- be low-cost
- effectively detect REM sleep
- wake the user after REM sleep
- be battery operated
- be compact and non-invasive
- meet AASM standards

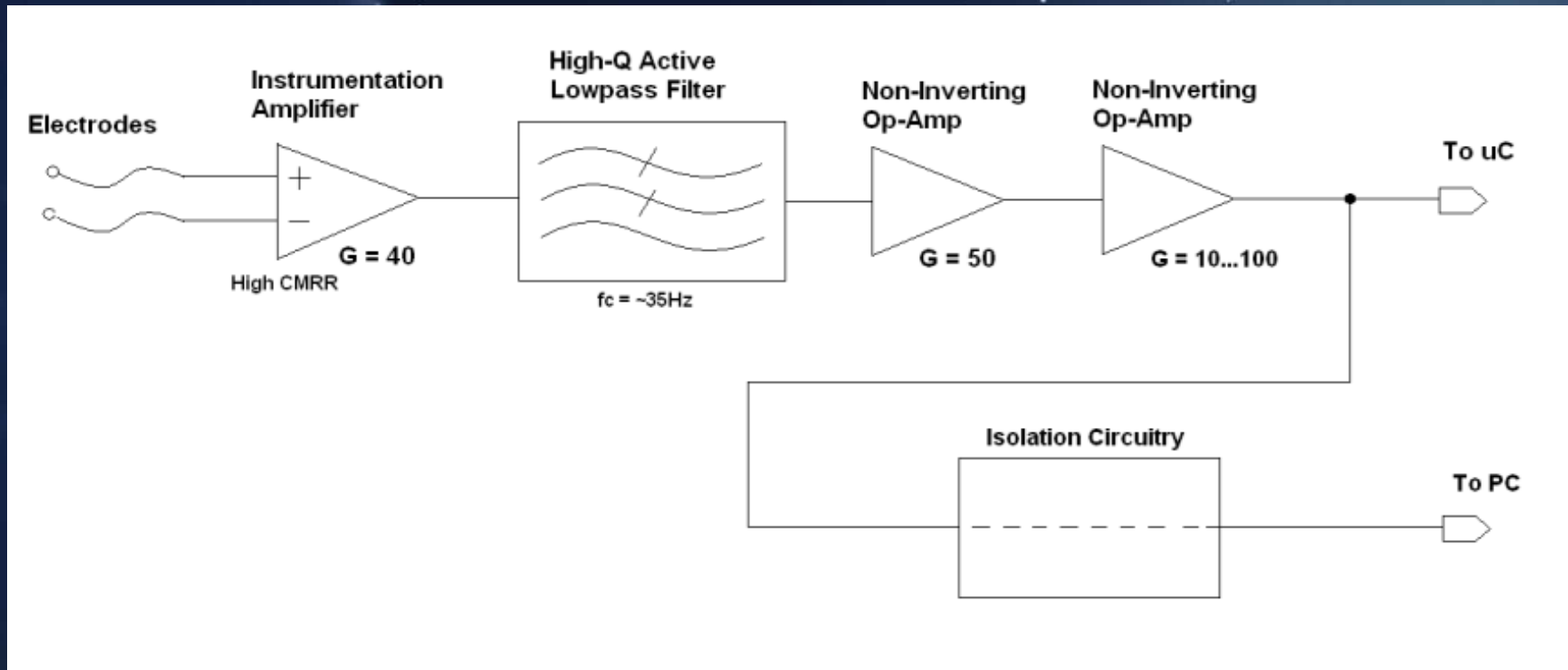
# Technical Content

## Hardware – Block Diagram



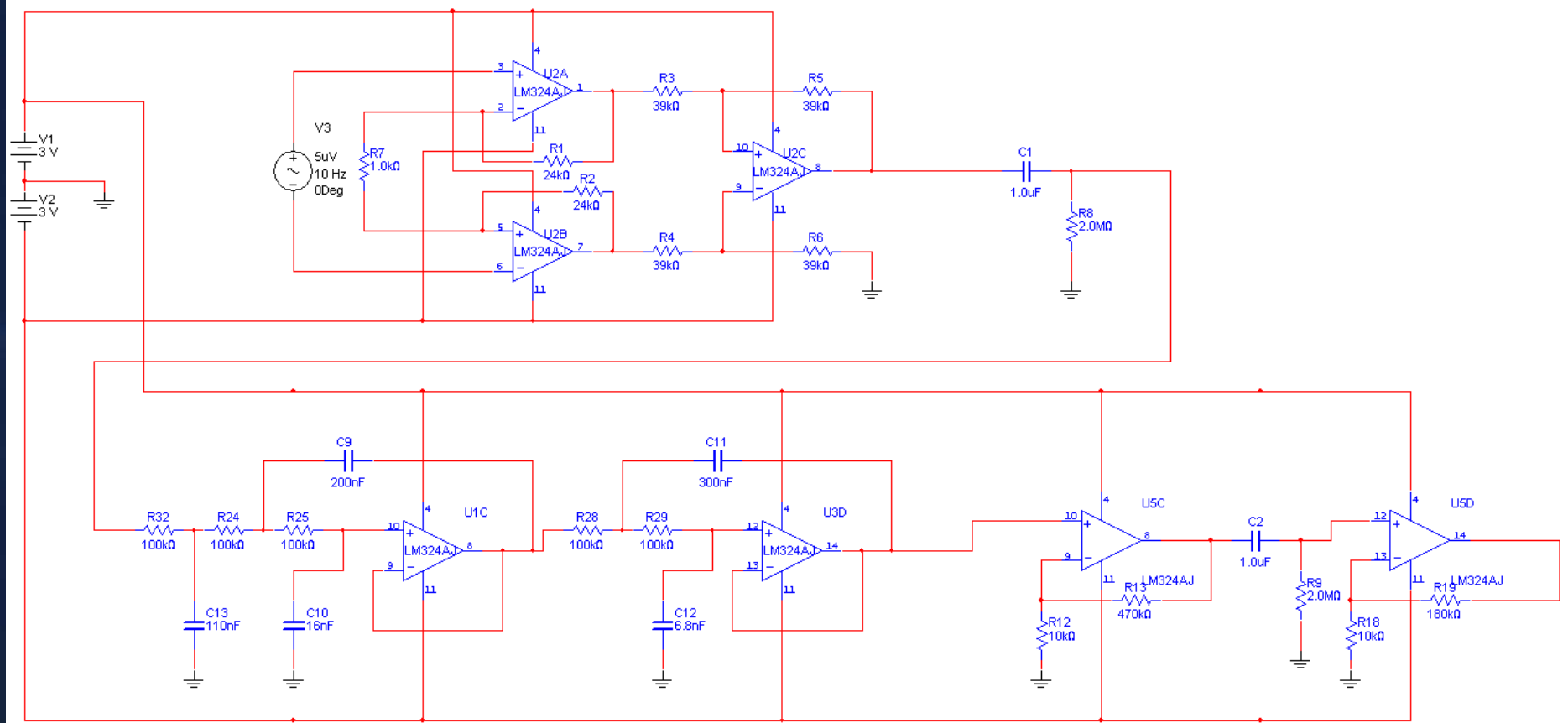
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## Hardware – Block Diagram



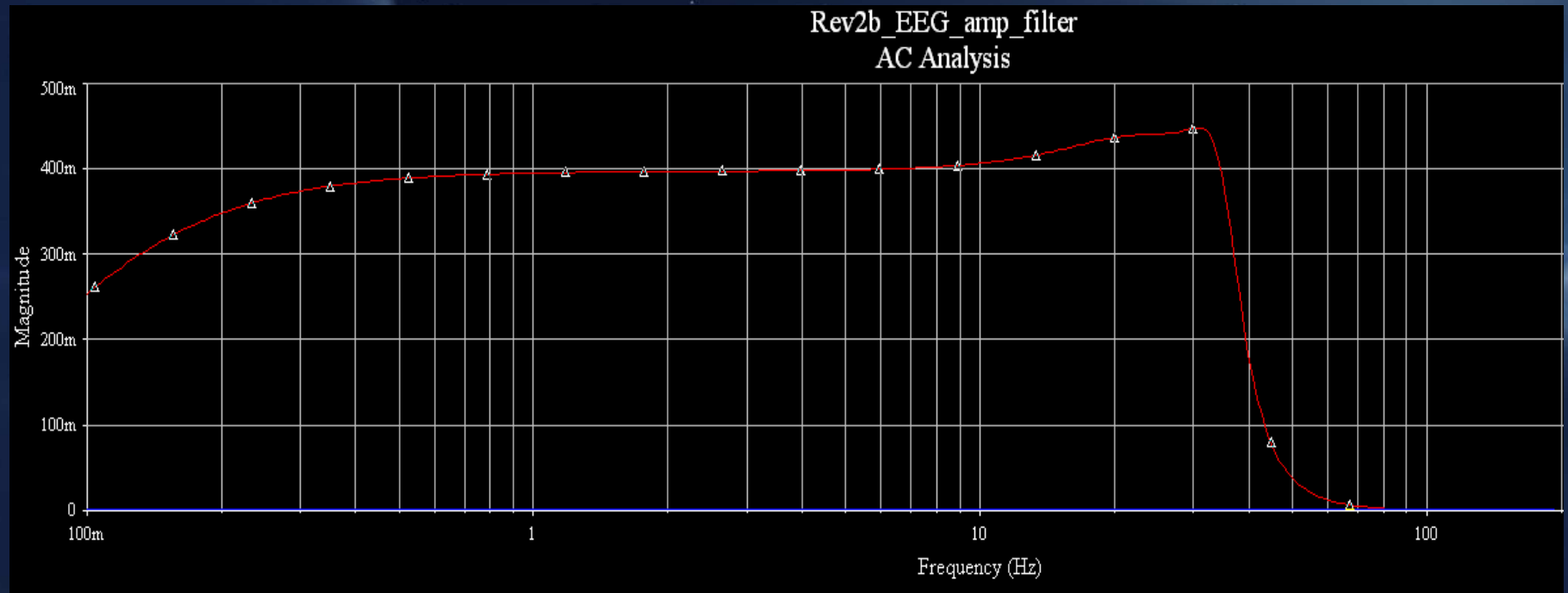
# Technical Content

## Hardware – Schematic



# Technical Content

## Hardware – Simulation



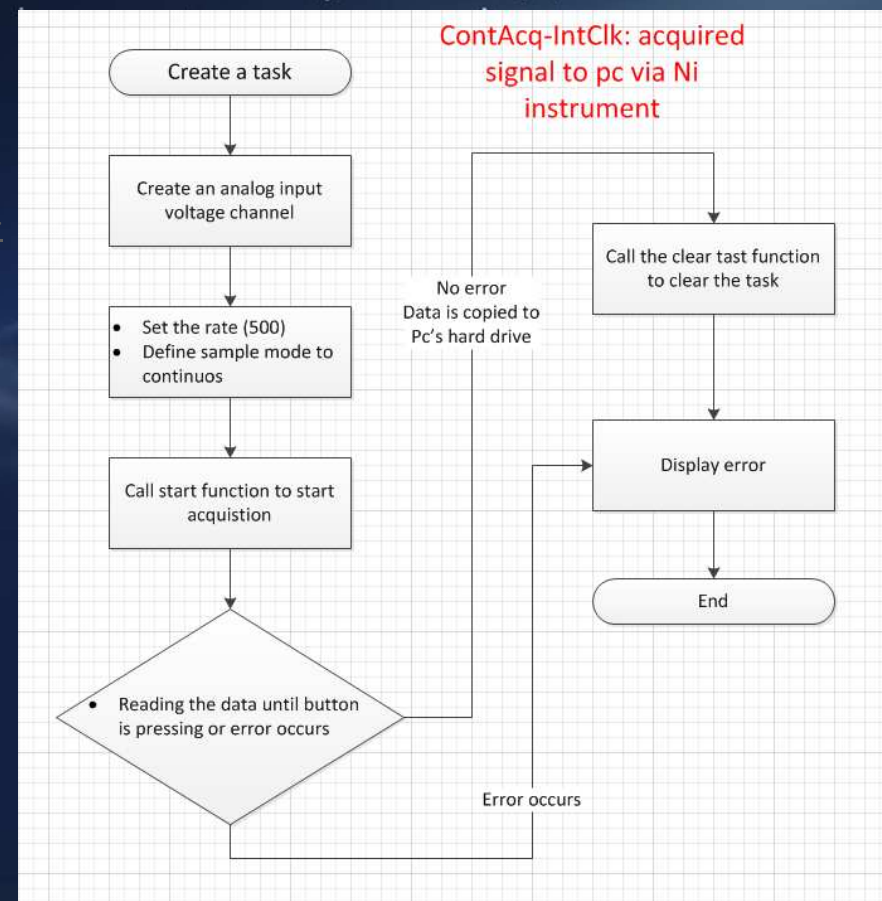
# Technical Content

## Software – Flow Chart

### Software:

- Acquired Data to pc via Ni instrument
- <http://forums.ni.com/t5/Multifunction-DAQ/DAQmxCfgSampClkTiming-question-about-sampsPerChanToAcquire/td-p/1574472>
- <http://forums.ni.com>

### Flow-chart





# Technical Content

## Sleep Considerations

- Sampling Rates      Min 200 Hz      Max 500 Hz
- Bandpass Cutoffs    .5 Hz and 35 Hz
- Analyzing Epochs
  - Movement Artifacts
  - How to score sleep
- REM
  - Sawtooth and often Serrated
  - 2-6 Hz
  - Low amplitude, mixed frequency signal
  - Eye Movements

# Technical Content

- Faraday Cage
  - 60 Hz noise
- Electrode Placement
  - Ear and forehead
- Signal Analysis
  - RMS Value
  - Threshold
  - Frequency Analysis

# Project Status

- One hardware circuit designed, built, and working
- An improved circuit is still in design, being simulated and debugged
- Program compiled and ready to take in raw data
- Considering isolation amplifier designs to use in human trials

# Budget

<u>Item</u>	<u>Retail</u>	<u>Acquired</u>
Sleep Scoring Manual	\$70	\$70
MCP602 dual op-amp (x4)	\$1.42 / unit	\$0
INA128P Precision Instrumentation Amplifier	\$11.75	\$0
Arduino Mega328 Microprocessor	\$35	\$0
Various Resistors and Capacitors	Cheap	\$0
Linear Rotary Potentiometer	~\$1	Not Yet Acquired
ISO1222 Isolation Amplifier	\$27	Not Yet Acquired
PCB (Out of House)	\$55	Not Yet Acquired
Electrodes	\$50	Not Yet Acquired
Vibrator/Buzzer	TBD	Not Yet Acquired
Housing	TBD	Not Yet Acquired

# Summary

- Our next design steps
  - Finalize Filter/Amplifier Design
  - Design Isolator Circuitry
  - Design arousal mechanism
- Data Acquisition and Analysis
  - Devise REM detection algorithm
  - Begin human sleep trials